



Pacific Northwest
National Laboratory



THE ENERGY ~ WATER NEXUS

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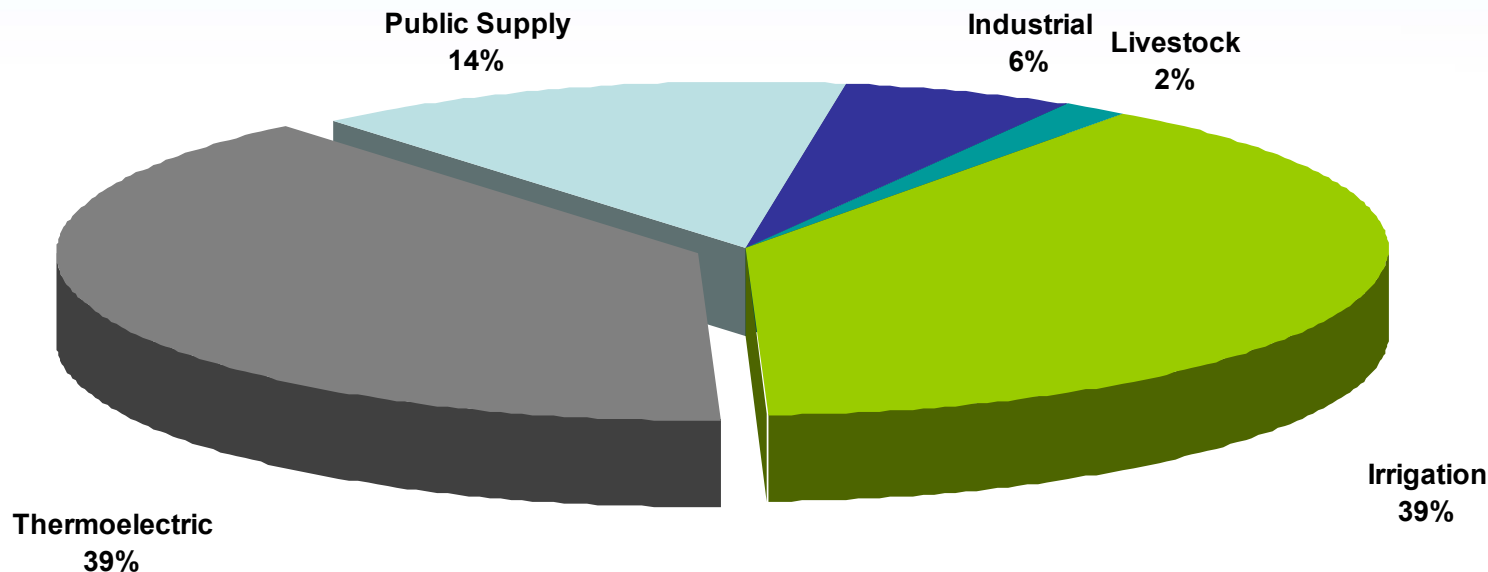
a strategy for energy and water security

Energy Security is Threatened at the Energy~Water Nexus

- Water is a limited resource
- Sustainable withdrawal of freshwater is a national issue
- Energy requires water and water requires energy
- Energy-Water issues require a regional perspective

As Much Freshwater Is Used For Producing Electricity As For Irrigation

Estimated Freshwater Withdrawals by Sector, 2000

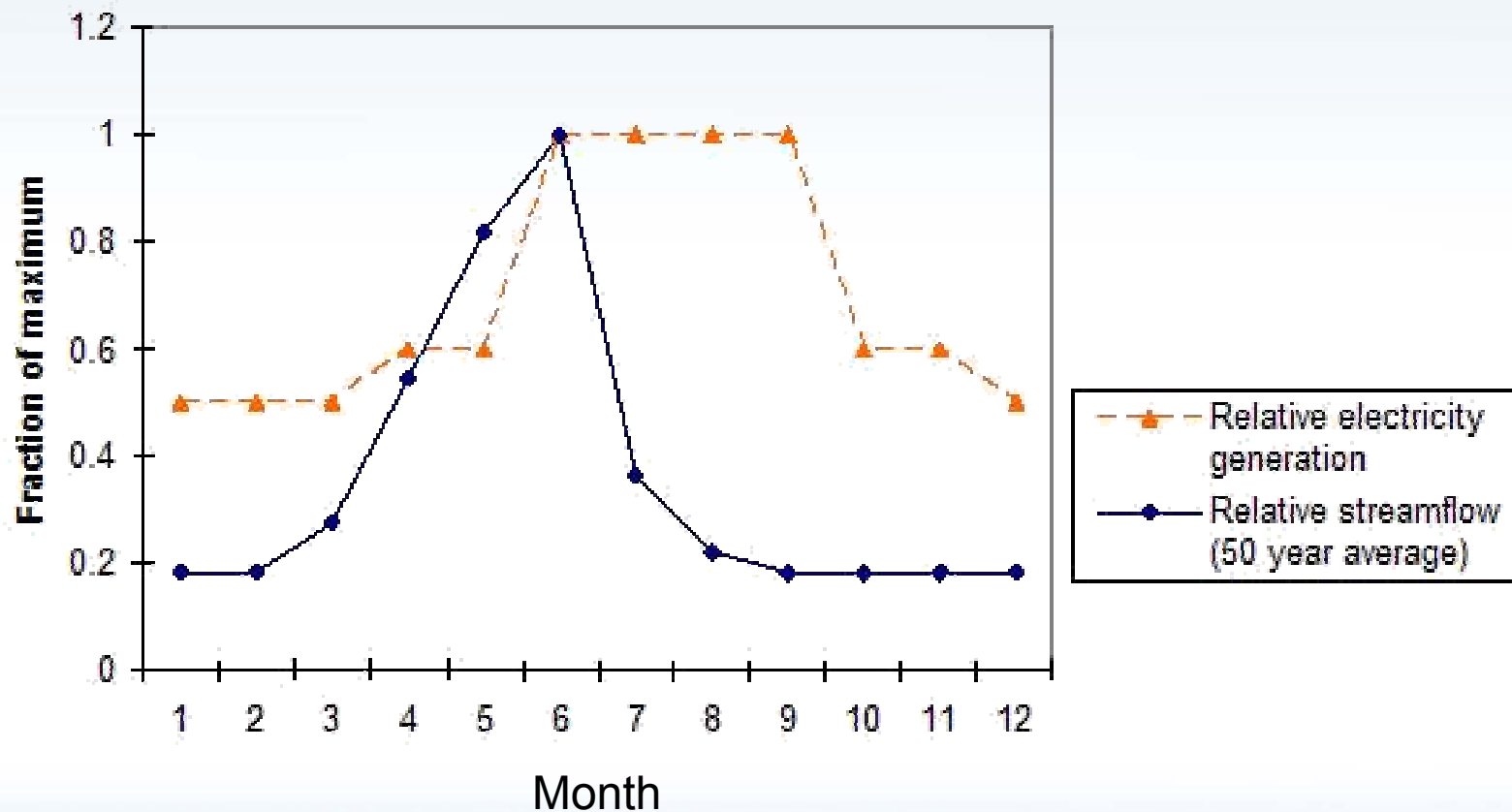


Source: USGS Circular 1268, March, 2004



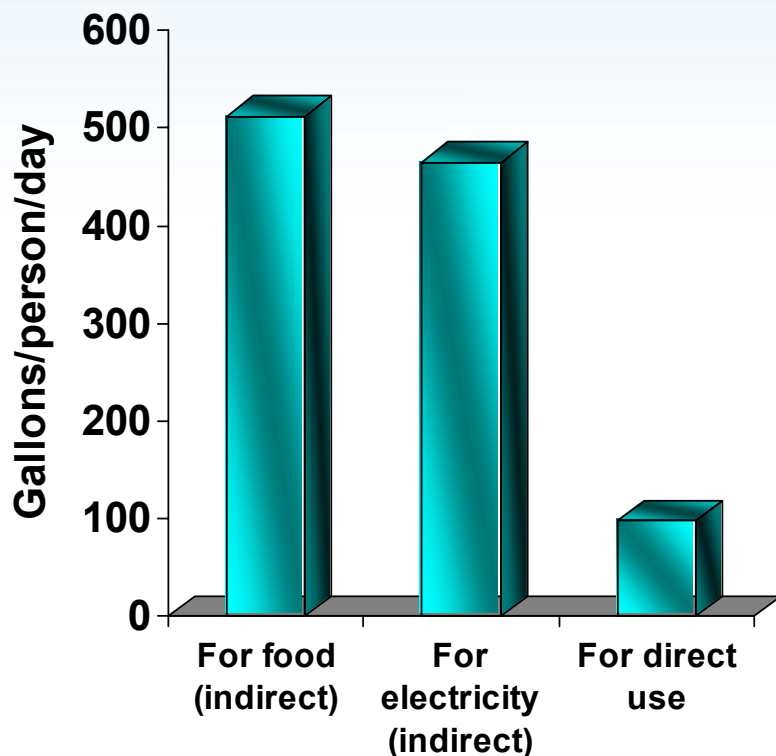
Seasonal Electricity Demand Often Does Not Coincide With Water Availability

Illustrative example (Southwest)



Energy Requires Water

Water required to produce household electricity exceeds direct household water use



GALLONS PER PERSON PER DAY

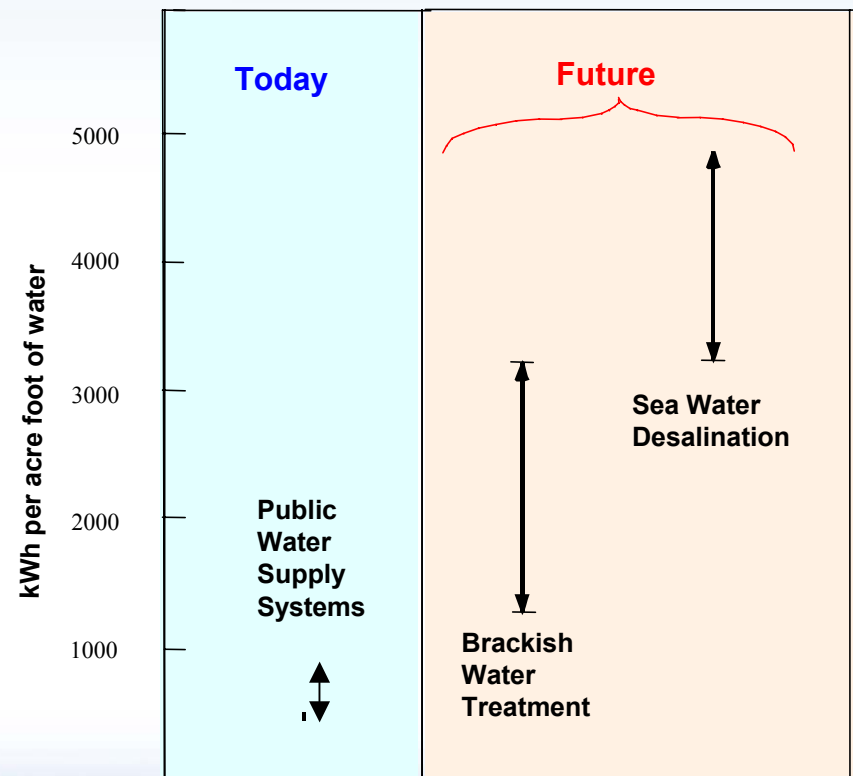
- 510 for food production
 - includes irrigation and livestock
- 465 to produce household electricity
 - Range: 30 to 600 depending on technology
- 100 direct household use
 - includes bathing, laundry, lawn watering, etc.

Water Requires Energy

Treatment of future water supplies will be energy intensive

- Readily accessible water supplies have been harvested
- New technologies are required to reduce energy requirements to access non-traditional sources (e.g., impaired water, brackish water, or sea water)

Power requirements for current and future water supply



Source: EPRI (2000), Water Desalination Task Force (2003)

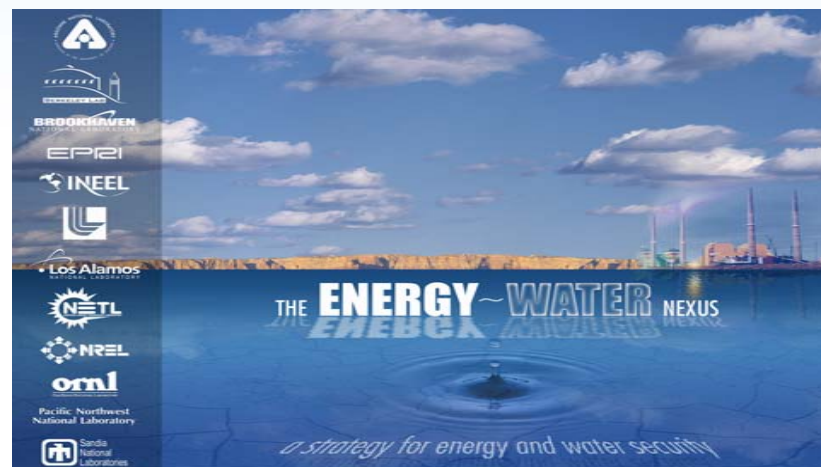
Critical Questions: we need the answers!

- How much water will advanced energy technologies (hydrogen, biomass, nuclear, FutureGen) require?
- How will spatial and temporal variability of water resources affect energy systems? Water quality?
- What impact will increased competition for water resources have on energy policy?
- What are interdependencies between water, energy and other critical infrastructures (e.g., public health, emergency services, transportation, telecommunications)?
- How will environmental regulations and policy impact the energy~water connection?

DOE Labs are Starting to Identify Assessment and Research Needs at the Energy~Water Nexus

- Regional workshops, independent laboratory activities
- Energy~Water Nexus Team:
 - Washington, May 2003
 - Chicago, October 2003
 - Dallas, January 2004
 - Washington, February 2004
 - Berkeley, March 2004
- Next steps:
 - informational briefings to DOE
 - Identification of regional R&D needs

Energy~Water Nexus Team



Representation from all DOE Multi-Program Laboratories



Goals of an Energy and Water Program

- Ensure that water resource quantity/quality is sufficient for new energy development and economic growth
- Minimize adverse impacts to water quality from energy production and use
- Reduce water use intensity by the energy sector
- Reduce energy use in water delivery and treatment systems
- Decrease energy and water use by industries and buildings
- Support water supply and treatment infrastructure
- Support sound energy~water policy and management options



Assessment, Science & Technology Research Needs for an Energy-Water Program

- Quantification of water needs for sustainable energy development
- Prediction of gaps in regional water availability and energy sector demand (seasonal-to-decadal time scales)
- New science and technology for advanced water treatment, energy-water conservation, and reduced environmental impacts
- Science basis for energy-water policy decisions
- Information and decision tools to define the interdependencies between water, energy and other critical infrastructures
- Solutions to emerging conflicts among environmental quality, water allocation, and energy development

Growing Awareness Exists in Congress of Need for an Energy-Water Program

- Energy Policy Act of 2003
 - Section 961, Subtitle (f) Water and Energy Sustainability Program
 - Calls for DOE to:
 - Assess
 - Future water resource needed for energy
 - Future energy needed for water purification and treatment
 - Use of impaired waters by energy
 - Technology for water use efficiency
 - Develop Program Plan
 - Scientific and technology requirements
 - Decision tools
 - Demonstration projects
 - Information transfer

DOE and National Laboratories must actively partner with industry, academia, key agencies, and State and local institutions.

New York Regional Energy-Water Workshop Outcomes

- Identification of the most pressing and important energy-water issues facing New Yorkers
- Information exchange and collaboration among stakeholders involved in energy-water issues
- Agreement on the goals and next steps for a research effort to address New York issues identified in the Workshop